

490
K3

THE
FURTHER REPORT
OF
JOHN SMEATON, ENGINEER;
IN
ANSWER
TO THE
QUERIES
PROPOSED BY THE
COMPANY OF UNDERTAKERS
OF THE
GRAND CANAL,
The 3d of AUGUST, 1773.

D U B L I N:
PRINTED BY J. and W. PORTER;
FOR R. MATURIN, and Co.
STEPHEN-STREET.

M,DCC,LXXXII.

REINER KILB

JOHN SWANSON

A. J. WILSON

W. L. R. E.

W. L. R. E.

W. L. R. E.

The 2d of August, 1877

W. L. R. E.

W. L. R. E.

**THE
FURTHER REPORT
OF
JOHN SMEATON, ENGINEER.
TO THE
COURT of DIRECTORS
OF THE
GRAND CANAL.**

GENTLEMEN,

I NOW sit down to give you a more particular Answer to the Queries that you did me the Honour to put into my Hands in the Month of *September, 1773*, than from the Want of Time, and of some Circumstances necessary to be ascertained for the forming my Opi-

B

nion

nion at large, after a general View of the Premises, (which was taken in fourteen Days) I was then enabled to do; but yet upon which View I took the Opportunity of suggesting some of the great Outlines relative to this Business, in the Report I then made to you, bearing Date the 6th of *October* following; and though a considerable Length of Time has elapsed since the Date of that Report, and several Steps have been taken by the Company in Consequence thereof, which in some Respects alter the Face of the Business, yet, as the grand Point then in view, of carrying the Navigation from *Dublin* to the *Shannon*, still stands an undetermined Question, both as to the absolute Practicability thereof, and as to the most practicable and advisable Mode of carrying the same into Execution, I flatter myself that what I now have to say will not come out of Season, or be less to the Purpose on account of the Length of Time that has elapsed; which has, in Fact, put it in my Power more maturely to weigh and consider the Circumstances attending, and likely to attend this Business; and as my said Report of the 6th of *October*, 1773, contains a considerable Quantity of Matter in answer to the Subject of those Queries;

Queries; and as this Report has been printed,
 together with the said Queries, which I con-
 clude is in every ones Hands any ways interest-
 ed in this Matter, to avoid unnecessary Repe-
 titions, I shall in this further Report or Answer
 to the said Queries, occasionally refer to the
 said printed Copies of both; and that we may
 go on more smoothly together, I must desire
 that the said Queries and Report may be laid
 before you, and that you will take the Trou-
 ble of numbering the Paragraphs of the Re-
 port from 1 to 22, (exclusive of the P. S.)
 to which, by this Means, I can more easily and
 readily refer; and though I have now several
 Matters to touch upon, which will not come pro-
 perly in direct Answer to any of the Queries,
 yet as, in the Preface to the Company's Queries,
 I am desired in general Words, *to report in Writ-
 ing the Lines I would recommend, and the Plans
 according to which I would advise the Undertakers
 to proceed in making them navigable; and to ad-
 vise what I think necessary, not only with regard to
 the Constructions and Dimensions of the Locks and
 Navigation, but also the Mode of conducting and
 carrying the same into Execution, in the most ef-
 fectual and expeditious Manner, for the common
 Good of the Kingdom, and Interest of the Under-
 takers;*

takers; under these general Directions, I shall beg Leave (after answering the Queries one by one, with References as aforesaid) to subjoin what I have further to offer upon this Subject.

Answer to Query 1st.

THE several Objects of this Query are local Circumstances, which it requires to be well acquainted with the different Kinds of Merchandize and Manufactures of the Kingdom of *Ireland*, that are likely to pass upon this Canal, and the Situation of Trade in the City of *Dublin*, to answer properly; which the short Stay that I had it in my Power to make, did not enable me to do; and at last it is rather a Question to be answered by Merchants, Traders, and Manufacturers, than by Engineers. It does not however to me appear, that on Supposition of the Canal's not entering the City itself, its present Termination is ill chosen; and at any Event, a large Wharf and Ware-houses will be wanted at the present Termination. I would advise to begin with a very moderate one at first, to be added to as Occasion shall require, but to be positively ready, as soon as the Navigation shall be compleated, from *Sallin's-bridge* to the present Termination at *Dublin*,
for

for I can find nothing so common, after much Impatience in getting a Stretch of Navigation compleated; yet in a great Measure to lose the Use of it for some Time, for Want of Warehouses at *both Terminations*; but a very moderate one will always do at *Sallin's-bridge*, as the Navigation is proposed to go further. See Report, Paragraph or Article 17 and 18.

To the 2d.

THIS is almost fully answered in Article the 18th, so that it is only necessary to add, that the Water that brings Vessels from *Sallin's-bridge* will lock them down to the *Liffey*; and as many Vessels, notwithstanding such Communication, will yet deliver at the present Termination, and return West, there will be a Redundancy of Water at the present Termination.

To the 3d.

THIS is fully answered in Article 8th.

To the 4th and 5th.

SEE what is said in Article 7th, and first Part of the 8th, to which I must add, that the only Question remaining in Query 4th, is, where to cross the *Liffey*, whether at *Waterstown-ford*, or at the present Line, and how
to

to be crossed? Respecting the latter, I have at present no Doubt but that it will be best crossed upon an Aqueduct Bridge, nor do I look upon the Reason given as valid, for preferring *Waterstown-ford* to the present Line, viz. because upon the present or Mr. Omer's Line, the *Liffey* is ten Feet deep in the lowest State of the River; at *Waterstown-ford* only three Feet deep; doubtless the Ease of Building a Bridge, simply considered, is greater at the shallow than the deep Water; but as the River *Liffey* must have at all Times a sufficient Passage, and on the same Width, the deeper the Water the greater the Section, as well as relative to the same Depth, the greater the Width, the greater the Section, the Determination of the Preference should rather follow the Quality of the Foundation than the Section of the River. At either Place, Rock, firm Clay, or strong Gravel, is preferable to Bog, soft Clay, or Sand; and if the present Section is not suitable to the Water that is to pass, it can at either Place be made so. The Weather being rainy, and the *Liffey* swelled, so as not to admit of crossing it any where except on Bridges, prevented my making any actual Examination of the Foundation. An accurate Section being therefore

therefore made of the River and Valley, describing by Borings or Diggings the Qualities of the Soil, then the proper Construction of the Bridge may be ascertained and advised upon; and it is now time to enquire into this Matter, so that the same may be ascertained.

IN further answer to the 5th, I observe, that the Hill or Rise of the *Downings*, where it is at present opened, is a very firm Limestone-gravel, which seems to stand very firm at an Angle more elevated than 45 Deg. and I am told this Limestone-gravel laid upon the Bog, produces an excellent Meadow Soil; but it is of little Use for me to expatiate to you on a Piece of Husbandry which I first there learnt myself; however, as the whole Country, where not covered with Bog, seems chiefly of the same Kind of Gravel, it is, however, intrinsically valuable, by no Means so scarce as to fetch it from *Downings*, in preference to an easier Place.

To the 6th.

I can by no Means advise such deep Sinkings, as are here suggested; it will be found a very sufficient Undertaking to get it down to
the

the Level of the *Blackwood-river*, which, as shewn in *Mr. Trail's Sections*, appears to be the least Sinking that can be dispensed with, to obtain Water to the Canal of Partition.

To the 7th.

THE Hill of *Downings* is so firm a Gravel, and appears to be capable of standing so much steeper than any Kind of Earth, Clay, or Gravel Soil, that I have seen before, that I look upon Arching to be altogether unnecessary.

To the 8th.

HAVING considered the Nature of the *Bog of Allen*, with all the Attention I am able, I can by no Means retract what I have said in my former Report, the latter Part of Article the 8th. I don't however mean to be understood, that I think a considerable Degree of Difficulty to form Canals in Bog, where you can *choose your Level*, so as never to have any extra Cutting or Banking of more than three Feet.

WHEN a Person takes a Ride upon the *Downings*, or any Eminence on the Border of the *Bog of Allen*,

Allen, and casts his Eye on that very extensive Flat, no Person would imagine any Difficulty in carrying a Canal over it, or across it in any Direction. I don't then wonder, that when Lord *Strafford* first cast his penetrating Eye upon this Bog, and perceived it gave rise to some of your principal Rivers, which run from it in different Directions, he would readily form a Design for their Communication through this Bog as their Center; and I can as readily conceive that those who have gone after him, making use of *ocular Inspection only*, have as readily conceived, that the Practicability of this Scheme was exceeding easy. This, on *ocular Inspection*, has in general been *taken for granted*; it has only been by the late actual Levels taken, that the Difficulty has in any Degree appeared. Thirty or forty Feet of Slope in ten or twelve Miles, looks to the Eye like a perfect Plain; but when this comes to be reduced to a Water Level, it will create a terrible Sinking or Banking. It appears by those Levels that the middle Part of the Bog is the lowest of all, above 30 Feet lower than the same Bog at the East and West Ends, while those are lower by above 20 Feet than some of the intermediate Parts, and

and are further barred up by very considerable Rises that cannot be avoided; that is by the *Downings* at the East End, rising no less than 41 Feet above the Level of the *Blackwood River*, and at the West End at *Knockballyboy* by an Ascent of 31; so that the natural Drainage of this Bog, forming the Heads of Rivers, is by the Middle, taking their Courses North and South, in a Direction quite contrary to the desirable one of going from the East to the West. Mr. *Trail* has very judiciously endeavoured to avoid this Difficulty upon the Line first chalked out, by making two Canals of Partition, and thereby sinking the middle Part of the Canal; but still, notwithstanding those different Levels, there frequently occur Sinkings of the Canal in the Bog from 18 to 33 Feet deep, for considerable Lengths together, exclusive of the deep Sinkings of the *Downings* and *Knockballyboy*; which, though I do not say they cannot be done, yet they cannot be done by any Method that is known to me, or that has been suggested or pointed out to me, in any *given Time*, or subject to any *given Estimate or Expence*; it is a Kind of Undertaking that has in this Degree of it never been executed to my Knowledge, or attempted.

attempted: Every Thing that I have done, or seen done in Bog, even in moderate deep Sinkings, has been attended with Difficulty, and uncertain Expences; while at the same Time, where the Level of a Canal can be carried superficially upon Bog, it is a Thing perfectly easy.

THE Piece of Canal that has already been attempted in the Bog, by no Means convinces me of the Practicability of the Thing; what has been done is no Ways a Specimen of what is to do; it is not sunk to the Depth nor Width; the Bottom is upon a considerable Descent, capable of carrying off the Drainage, and has been open for that Purpose several years, being begun by Mr. Omer.

THE Fact is, wherever I have seen tried, that till you get 4, 5, or 6 Feet deep (according to the Firmness of the Bog) you go on very expeditiously, and without any Difficulty; but in going deeper, though the Bog may be very Firm at Top, yet underneath, retaining a great Quantity of Water, like a Sponge, it becomes very heavy, and not readily parting with its Water, the upper Part begins to press
out

out the lower, or slide itself into the Cavity; and so keeps coming in, as you take it out, till the whole Surface is lowered to a considerable Distance; the sinking a little at a Time, as for Instance, one Spit of a Spade annually, giving in the mean Time Leave for the Water to drain off, and the adjacent Bog to consolidate, is the best Method I know of; and thus, with much Labour and Patience, you may get 10 or 12 Feet deep. *Drain the Bog*, say they that think it easy; true, this is a very effectual Method, but then it is in this all the Difficulty consists; no Drain can operate below the Level of the Water it contains, and by the same Rule that you can make a Drain a Foot wide, *and keep it open*, you may make a Canal of 50 Feet wide, and keep it open to the same Depth. I do not mean to limit other Mens' Capacities, or to preclude the Company from being advised by those Artists who may see clearly what I don't, or whose particular Experience may have led them further into the Prosecution of this particular Subject than I have had Occasion for; but I must say, that my particular Experience, so far as it has gone in this particular Subject, suggests this Maxim, *avoid a Bog if you can as well, but*
by

by all Means possible the going deep into it; nor will any Consideration prevail on me to pronounce that practicable, that I can foresee no adequate Means of effecting; and for this Reason I must answer this 8th Query in the Negative.

To the 9th.

FROM what is said in the preceding Answer, it will easily be inferred, that if the carrying the Canal upon different Levels, in the present Line, will be attended with extreme Difficulty and uncertain Expence, the carrying it *on one Level* will be, respecting Mens' Strength and Abilities, altogether impracticable.

To the 10th.

IN Answer to this see the 9th Article of former Report; in Consequence of which, and of the Resolution of the Committee thereon, Mr. *Trail* and Mr. *Jessop* proceeded upon the Level of the proposed new Line from the *Wood of Allen to Phillipstown*, of which Levels Mr. *Jessop* made his Report to me; and as I understand Mr. *Jessop* left a Duplicate thereof with the Company's Secretary, it is unnecessary to state them here. From these Levels it
appears,

appears, that the Ground in this Line is much better adapted to carry the Canal of Partition upon one Level, than the former Line; and from the Remarks, it appears probable, that this new Line may be yet further improved; but yet as there appears to occur necessary Differences of Level *in Bog* of thirty Feet or upwards, it does not seem better adapted to carry the Canal of Partition upon *one Level* than the former Line upon *several Levels*, as laid down in Mr. *Trail's* Section; and in case more than one Canal of Partition is introduced, it is very immaterial into how many different Levels each Descent from its respective Canal of Partition is broke. By the known Principle in Artificial Navigation, *whatever Number of Locks there are in one Descent, they are all worked by the same Water that will work the largest*; and in regard to increasing the Number of Locks, as they are capable of being reduced to an Estimate, I think little of building a few additional Locks, when put in contra-Distinction to inestimable Difficulties; I therefore, upon the whole, cannot avoid coming to the same Conclusion upon the former Part of this Query, as upon the Eighth.

THE

THE latter Part of the 10th Query is answered at the End of the 8th Article; to which I have only to add, that *from Phillipstown* I see no Likelihood of finding a better Passage than through the high Grounds of *Knockballyboy*, and by the *Maiden* and *Brusna* Rivers.

To the 11th.

OF the three Tracts here mentioned, having reconnoitred the Country between *Naas* and *Atby*, see Article 22d.—Now in case I thought that a Passage by the present Line through the *Bog of Allen*, as proposed upon several Levels, an *executable Scheme*; that is, a Scheme attended with such a Kind or Degree of Practicability, that I would recommend the Execution of it; then a Branch Canal from the lowest Part of the Main Canal, between the *Cush* and *Figuile* Rivers, will be far the most proper, as being not only shortest, but there would be very little Difference of Level, but what might be surmounted by one, or at most, two Locks, between the *low Level* of the Canal and the *Barrow* at *Portarlinton*; and as there would be Water coming down from both the Canals of Partition into their low Level, they could not fail of Plenty of Water to work them down to the *Barrow*; but as I cannot re-

commend this Scheme as being sufficiently executable, it will remain that the *Blackwood* River will be the advisable Passage to the *Barrow*. See Article 10th, and the Reasons given in Articles 11th, 12th, 13th, and 14th. I would not, however, recommend the Passage by the *Blackwood* to fall into the *Barrow* at *Monaster-even*, for Reasons that will hereafter be given. I would recommend the Canal Vessels and Locks of the same Size as recommended in my Report, Articles 4th and 5th.

To the 12th.

IF either the present Line, or the new one traced as per Query 10th, could be recommended as executable Schemes, then a Branch from the Canal to fall in with the *Boyne* near *Edenderry*, would be best to be adopted. See Article 21st. But on a contrary Supposition, I should prefer the joining of the *Blackwater* with the *Blackwood* River, for Reasons that will be subjoined. Its Locks and Boats still of the same Dimensions.

To the 13th.

THIS being a local Circumstance, I am not enabled to give a general Answer.

To

To the 14th.

Lock Houses at particular Places, are absolutely necessary, and every Lock should have a Lock House was it not for the Expence. At particular Places they are necessary for examining the Cargoes, and ascertaining the Tolls; at particular Places they are necessary also, for the proper Regulation and Distribution of the Water; and at every Lock they would be useful in being a Check upon the Boatmen, and idle and evil-minded Persons, in improperly and wantonly spending the Water, and damaging the Works and Machinery.

To the 15th.

THE Dimensions of Boats, Locks, and Canal, are amply set forth in Article 4th, 5th, and 6th; and to Locks of this Size, less than a Third of the Water will be sufficient, that will be necessary to work the Locks, such as have been built by Mr. Omer at *Clonaughless*, &c.

To the 16th.

As the Season was rainy when I saw the *Blackwood* River, I have not the Means of judging of the specific Quantity of Water it

affords in dry Seasons; but for the Locks as now proposed, I apprehend the *Blackwood* will be sufficient to carry on a Navigation to a considerable Extent of Business; which Stock of Water may be considerably increased by forming Reservoirs for treasuring up the Waters of the *Blackwood*, &c. in rainy Seasons; to which End several Hollows in the Bog, lying above the Level of the Canal of Partition, will be subservient; into which the Flood Waters of the *Blackwood* can be introduced, Dams being put across the Outlets by which those Hollows are naturally drained.

To the 17th.

THE Quantity of Water that will be necessary, will in great Measure depend on the Quantity of Trade that will be carried on; it seems that the *Blackwood*, especially with Reservoirs, will be sufficient for the first Outset, and as the Trade increases, the Finances do also, and then additional Supplies of Water can be afforded to be bought at greater Distances and Expence. Mr. *Trail* informed me, that by a Level actually taken, there is a Fall from *New-bridge* upon the Liffey of 23 Feet to the Canal of Partition at
Dawnings,

Downings; which, in a Space of about 6 Miles, is very sufficient to carry any Quantity of Water thither that can be required. On viewing the Country, it appears very practicable, after erecting a Dam across the *Liffey*, a small Space below *New-bridge*, to take Water into an Aqueduct on the West Side of the *Liffey*, and passing by *Roseberry*, or *Raspberry*, to follow a Level, upon the Ascent of the Ground from the *Liffey* towards the West, and leaving the Bridge of *Canagh*, and the Mill of *Cabbear-teally*, on the Right, to fall in with the Canal of Partition at *Langanstown*; this will avoid the deep Cutting, that seems otherwise unavoidable, to come at the Canal of Partition, by way of the Bog of *Danore*, the Summit or Neck of that Bog being proved higher than the Passage by the *Downings*, if the *Liffey's* Water is not unnecessary at the Canal of Partition, where it will be wanted in double Quantity: That is, to distribute a Lock full each Way, on the Passage of each Vessel, it can hardly be wanted on the *Dublin* Side only, where with great Ease the *Morrel* River can be taken in.

To

To the 18th.

I LOOK upon it as necessary to take in the *Morrel* River, which very conveniently can be done by an Aqueduct from *John's-town* to near *Sallin's-bridge*, which will not only be of great Assistance in supplying the partial Navigation that will always obtain upon this District of the Canal, but be absolutely necessary for the supplying it, before it is joined with the Canal of Partition. From Observations upon the Quantity of Water used by the Mill at *John's-town*, upon the *Morrel* River, it is capable of supplying 39 Lock fulls per Day, in the driest Season, of such Locks as have been by me proposed, supposing them to pen 12 Feet difference; and if, notwithstanding, Water should be scarce, it will be proper not to let Vessels pass the large Locks but in Pairs, and if possible to bring together Vessels passing both Ways, so that four Vessels may pass the great Locks with one Lock full of Water,

To the 19th.

THIS is already in a great Measure answered; if wanted at all, they cannot be too large. I look upon a Reservoir of 50 Acres, capable of holding at a Main of the Area, 6 Feet depth

of

of Water as a moderate Size ; such a Reservoir would hold about 42 Lock fulls upon an Acre, and upon 50 Acres 2100, say 2000 Lock fulls, which at two Lock fulls to a Boat, and ten Boats per Day, will last (exclusive of Leakages) 100 Days ; and this, or other Reservoirs to the Amount of this, being formed in the Bog itself, will be made at little Expence, where the Inheritance of the Ground is valued at so reasonable a Price.

To the 20th.

My former Report recommends Article 17th, the first finishing to *Sallin's-bridge*, which Advice I am glad to find you have taken, by contracting for the Works with Mr. *Trail*, upon the Dimensions and Depth of Water, advised by Article 5th ; the next Thing I would advise to be undertaken, is the deep Cutting of the Neck at the *Downings*, for the Reasons specified in Article 19th.

To the 21st.

I APPREHEND, that Places upon the Canal for the Deposition of Implements and Utensils are indispensable ; that the Company's general Stores in *Dublin* are by no Means sufficient

cient and convenient, without others nearer to the Centre of the Works, *pro tempore*, and yet that a Place for the Reception and Deposition of Stores, as well as for the manufacturing of some Articles, will always continue necessary at *Dublin*. But yet I apprehend, when the Canal becomes navigable for some Miles, from the *Dublin* Termination Westward, that the Situation of the *Dublin* Store-yard will be more proper at the Canal near the *City-Bason*, than in *St. James's-street*; the very Ground and Buildings intended for Wharfs and Ware-houses, may very properly be used as Store-yards and Store-houses, till they are wanted for their proper Use; and, as said before, may be added to as Occasion may require. The Store-yard at *Stackumney*, being near the *Gollerstown* Quarries, and central to the Works between *Dublin* and the *Liffey*, I apprehend to be very properly chosen.

To the 22d.

THE Materials that I have seen made use of by the Company, are in general of the best Quality, only I have thought proper to recommend the Use of *Porfelana* for Mortar, in Preference to *Terras*; the Reasons for which,
as

as well as a full Answer to this Query, is found in Article 20th of my former Report. I will only add, that *Porfelana* Mortar does not spoil like *Terras*, by becoming dry, or wet and dry, nor doth it grow in the Joints.

To the 23d.

THIS is also fully answered in Article 20th.

To the 24th.

THIS is fully answered in the 8th Article.

To the 25th.

IN REGARD to the Situation of Mills, Bleach-yards, &c. those are secondary and local Considerations, about which my Time and Information are not sufficient; but as the Company can hardly avoid making a Road, sufficient for a Turnpike, upon at least one Bank of the Canal, nor can they avoid this being made a Road of, it is likely that their Act enables them to erect Bars and take a Toll.

To the 26th.

THE Water that will necessarily be brought down the Canal by the Passage of Vessels, will be far more than will supply this Contract,

tract, and even if the Canal was hereafter continued down to the *Liffey* at *Dublin*, the partial Navigation of Vessels, that will deliver and load Cargoes at the present Termination, will in my Opinion be fully sufficient, and for which Purpose, it will always be the Interest of the Company to continue their Wharfs and Ware-houses there. As the *Morrel* Water appears to be fine and clear, and is said to be of the best Quality, it will be proper to let no more come down from the Canal of Partition than necessary; and to prevent it mixing with the *Morrel* Water, more than absolutely necessary, it will be proper to fix an Overfall at the West End of that Stretch of the Canal where the *Morrel* is introduced; by which Means all the Water coming from the Canal of Partition, that is not necessary for the Navigation of the Vessels to *Dublin*, will be discharged before it mixes with the *Morrel* Water.

To the 27th.

HAVING carefully perused a Paper, containing the Reasons for endeavouring to keep in the *Bog of Allen* as much as possible, rather than avoiding it, I must observe, that if those
Reasons

Reasons were valid, it would appear, that an Undertaking to drain and improve the *Bog of Allen*, or certain Parts thereof, would be far more lucrative than that of making a Navigation from *Dublin* to the *Shannon*; for I could chalk out a far less expensive Way of draining the Bog than by digging a large navigable Canal through it. As it is here stated, an Acre of Land is to grow from the annual Value of one Penny to forty Shillings, without the State of one Penny Expence to be laid out upon it; it is said indeed, that *Clay and Manure may be brought by Water to cover that Part of the Bog next the Canal, at a small Expence, and in very large Quantities*, but then the Quantities necessary to cover an Acre, together with the Expence of Water Carriage, should have been stated; it is very true, that Carriage from very great Distances in general is cheaper far by Water than Land, but for small Distances it is not. Suppose that *Limestone-gravel*, from the deep Cutting at the *Downings*, is to be had for nothing, it is yet to raise and to wheel on Board a Vessel; the Expence of Wear and Tear, or hire of the Vessel is to pay, and for the Mens' Wages to attend it, and Horses to draw it; it is then again to be put
in

in Wheelbarrows, and run out to *main Distance* of 175 Yards; which alone, upon great Quantities, will be a very considerable Expence; after which I should suppose it is to be spread, and regularly to be disposed of. Manure may indeed be brought hither from *Dublin* by Water, far cheaper than Land, yet I suppose it is at *Dublin* to be paid for, to be paid for leading from different Parts of the City to the Canal, to be put on Board, and the Freight to be paid for; and though the Company will reckon nothing for Tolls, yet the Wear and Tear of their Lock Gates, Banks, and Works, in common with other Vessels, will in Reality be so much out of their Pockets; again, the wheeling it 175 Yards, and spreading, together with the proper Seeds, will be a farther Expence; all these put together will be the Purchase of the Acre of Land. And though I doubt not but that Land may be thus made in favourable Situations to Advantage, supposing the Canal actually made and navigable, yet if in the making the Canal navigable, very great (and at present uncertain and unknown) Expences attend it, by forcing a Passage through the Bog in a Direction ill adapted to the same, it will be very easy to bury all the Profits of
the

the Land in the extra Work, upon a very few Miles of this Kind. It is said, that the Digging through the Bog is far cheaper than in the firm Land, not above one Third; I shall not at present dispute this Disproportion, and agree that where the Bog will stand, there is no cheaper Digging; but if I dig out a Cube Yard of Soil from the firm Land, *it is done*; but if under an Idea of digging out a Cube Yard of Bog, I have to dig out that, and *nine others* that will follow it, before I can make good the Yard I want, I apprehend the Balance will be on the other Side of the Book.

THE Query states, *whether it will or will not be much for the Advantage of the Company to carry the Line as far through it as can be done with Propriety*; I apprehend it may; but the Question turns on this, *where* it can be done with Propriety; and from what is here stated, and from what has been already said in Answer to Query 8th, it is very plain it will be on no Account to the Company's Advantage to go through the Bog where it will require *deep cutting*; and to fix some Idea to this Term, I mean where it will exceed 10 Feet deep; yet *this greatly differs, according to the natural Texture*

Texture and Firmness of the Bog.—My Answer therefore is, that where the Company have their Choice in going through the *Bog of Allen*, or not, without deep Cutting or high Banking, I apprehend it may be for *their Advantage*, and consequently for the *national Advantage*; but I can by no Means advise the Company to attempt to carry the Canal through every Thing that may oppose in the *Bog of Allen*, merely for the Sake of gaining and improving Ground; for at any Rate, it does not seem that a Navigation can be carried from *Dublin* to the *Shannon*, without going through so much of the *Bog of Allen* as will afford ample Opportunities of trying those Experiments.

ADDITIONAL CONSIDERATIONS.

HAVING now dispatched what occurs to me in Answer to the several Queries, in Order as they stand, I beg Leave to add such further Matters as have presented themselves to me since my former Report, which could not so directly be given in Answer to the Queries.

IN my former Report, Article 10th, I have strongly advised the Company first to compleat a Navigation to the *Barrow*, before they begin to work from the *Togher of Graig towards the Shannon*, for Reasons given in the 11th, 12th, 13th, and 14th Articles, which Advice I now repeat; and besides these Reasons, I beg Leave to add the following one, viz. That I am now fully convinced that this is the only *executable* and *advisable* Road to the *Shannon*; and by which Means not only the Junction of the *Shannon* and the *Barrow* with the *Grand Canal* will be united in *one* Interest, but also produce the most direct Communication of the *Barrow* and *Shannon*.

FROM

FROM what has been already stated, in Answer to the 8th, 9th, and 10th Queries, it does not appear likely, that any executable and advisable Scheme can be formed to obtain a direct Passage from the *Togher of Graig* to *Phillipstown*, upon one Level; nor, indeed, without extreme Difficulty, upon any Number of Levels. If, therefore, at any Rate, we must adopt at least two *Canals of Partition*, it will be more eligible to do it in such a Way as to draw every possible Use from this Construction. It has been already stated in Report, Article 10th, that the Junction of the *Barrow* with the Canal, by Means of the *Blackwood River*, will be perfectly easy; and in Point of probable Profit, advisable prior to, and independent of all the rest; suppose then, after the Meeting of the Canal with the *Blackwood River*, (which I will call the *fixed Point*) we carry the Canal down the declining Valley of the *Blackwood*, by *Rathangan*, as has been already proposed; but instead of inclining it towards *Monastereven*, it be inclined towards the Joining of the *Blackwood* with the united Stream made by the *Cush* and *Figuile* Rivers; which will be upon Ground very little elevated above the *Barrow* at *Portarlinton*, it being overflowed to a great Distance when I saw it. So far

far then; we may lay down, as at all Adventures expedient, for joining the *Barrow*, and taking in a Navigation from *Portarlinton* as well as from *Monastereven*, the best adapted possible. This Course, from the *fixed Point* to the Junction with the *Figuile*, will be, I suppose, about 9 Miles; from thence to the *Barrow* about 2; but ascending from the said Point of Junction of the *Blackwood* and *Figuile*, by the gentle inclined Valley of the *Figuile*, we shall in the Course of about 11 Miles, come to *Phillipstown Bridge*; so that this will be a Stretch of 20 Miles from the fixed Point to *Phillipstown Bridge*; according to the present Line, through the Middle of the Bog, it is 15; so that when you are arrived at the Joining of the *Blackwood* and *Figuile*, you are then 4 Miles nearer *Phillipstown*, by the Course of the *Figuile*, than at the fixed Point in crossing the Bog according to the present Line; according to Mr. *Trail's* Plan, the Branch of the Canal, to the *Barrow* at *Portarlinton*, which is the shortest Communication of all, is nearly 7 Miles; therefore, *Phillipstown Bridge* and the *Barrow* taken conjunctly in either Case, are joined by the fixed Point, by 22 Miles of Canal. It is true that the Course from the fixed Point, by the *Blackwood* and *Figuile*, in a Pas-

sage to the *Shannon*, being 20 Miles, is 5 Miles more according to the present Line, which is only 15; but then, as I apprehend there is no Proportion of Distance subsists between a practicable and an impracticable Passage, the Ineligibility, not to say absolute Impracticability, of any Passage from the fixed Point to *Phillipstown*, across the Bog, has been sufficiently pointed out. What renders the new proposed Line a practicable and an *executable Scheme*, is, that while you are following the Vallies of gentle declining Rivers, you are sure the general Surface is inclining one Way, and gradually either rising or falling, according to the Course you are going; so that, if in Bog, you can always *choose your Ground*, and by making Locks at proper Places, can always avoid deep Cutting and Banking; for, at any Rate, you can take the Trough of the River for your Canal; and it happens very luckily here, the Rivers run upon so flat a Bed, that according to the Levels taken, there should not be above 9 or 10 Feet difference between the Level of the united Streams of the *Blackwood* and *Figuile*, and at the Crossing of the Branches of these Rivers separately in the Bog; so that

I com-

I compute that there will not be required above one Lock more in compleating the Junction with the *Shannon* and *Barrow* taken together, than would be required according to Mr. *Traill's* Section.

IN taking the Distances above-mentioned, I have measured them by the Course of the Rivers; not, indeed, according to their small Meanderings; but their general Direction, as their Borders are in general flat; but when this Scheme comes to be surveyed by the Level, it is very probable that the Courses may be shortened, without encountering with deep Cuttings and high Bankings; and particularly that the Canal may be taken round, so as to effect a Junction with the *Blackwood* and *Figuile*, by a nearer Course than their natural Junction,

REGARDING the Passage of the *Downings*, I by no Means look upon it as a very formidable Obstacle in so great and extensive an Undertaking; the Soil is near upon the most favourable of all for such a Purpose, and which having reduced to Calculation, in my Opinion, may be done for the Sum of 13,500*l.* extra,

to the Expence of the same Length of plain Canal. In Fact, I look upon the deep Cutting at *Knockballyboy*, to be the more formidable Work of the Two, on account of the Uncertainty of the deep Cutting in Bog, no less than 31 Feet; however, as the Ascent is steep, and consequently the Bog very much upon the decline, it is naturally firm and dry, and as the Ease of Tapping the Underparts is proportionable, I hope, as all the Difficulties, after passing the *Downings*, will be reduced to this one, that it will not be found insurmountable. Yet still, if possible, it will be well to avoid this also; and though, from the Views I have had, I have seen no Probability of avoiding this Passage, if the Canal goes *by or near Philipstown*, as I have reported in Answer to the latter Part of the 10th Query; yet as, at the Time of this View, I had no Idea of making *Rathangan* in the Course from *Dublin* to the *Shannon*, I did not reconnoitre what might be done in effecting a direct Junction between the River *Barrow* and the *Shannon*; but now remembering that the Country was pretty flat in travelling from *Banagher* to *Portarlinton*, and observing that the *Barrow*, (which runs upon a dead Course for several Miles above *Portarlinton*)

lington) together with its Branches, form near Approaches to the Head of the *Maiden* or *Tullamore* River, to *Lough Pallas*, whose Waters fall into the *Maiden*, and to *Lough Staunoh*, whose Waters fall into the *Brusna*, and by a pretty direct Course by *Birr* to the *Shannon*. Observing also, that Mr. *Trail* in his Report, has mentioned an Information of a Passage by *Lough Pallas*, it is possible, that though such a Passage may not be eligible from the *Bog of Allen*, yet it may be so from the *Barrow*. I say, taking all these Considerations together, it seems well worth the Company's while, to order the Part of the Country now pointed out, to be reconnoitred; and if any Passage seems more favourable than that at *Knockballyboy*, to have a particular Survey, Levels and Section taken; and in Case the Company approve of this Proposition, either by the Way of the *Figuile* and *Knockballyboy*; or any Passage from the *Barrow* that may be more favourable; it will be also proper to have a Survey, Levels and Section taken, of all the Parts which have not been already reduced to Paper; and then I have not the least Doubt but that all the whole Work, the Bog Cutting at *Knockdallyboy*

boy (or something that may occur of the same Kind in making good any other Passage at the Western Summit) excepted, may be reduced to a fair and grounded Estimate, so that the Company may see what they have in Reality to do, in Order to effect this great and very desirable Work.

ACCORDING to this Construction, as well as that proposed by Mr. *Trail*, another Collection of Water will be necessary to supply the *Western* Canal of Partition; but as the *Eastern* will have the united Trade between *Dublin* and the *Barrow* to lock, as well as that of the *Shannon*, and the *Western* will have that of the *Shannon* only, with possibly a small Trade between the *Shannon* and *Barrow*, it is probable that much less Water will be wanted at the Western Summit than the Eastern. And to this End the Head of the *Figuile* River, above *Phillipstown*, will conduce; which, as I observe, turns a Mill near *Phillipstown*; this probably, with Reservoirs, will be sufficient. Yet it will be advisable (if this at last is found the most favourable Passage) to reconnoitre the Country, to see whether the Head of the *Tullamore* River, the Head of the *Esker*, or the Water from
Lough

Lough *Pallas*, or any other, cannot be conducted, by Aqueducts, to the Western Canal of Partition.

AFTER a Junction is made with the *Figuile*, from the *Blackwood*, (supposing the *Figuile* the most eligible Passage) and a Navigation effected from thence to the *Barrow*, at some convenient Point between *Portarlinton* and *Monastereven*, the Company will then be in Possession of the *Barrow* Trade; for as there is already subsisting a Navigation of a Sort from *Portarlinton* to the Bridge of *Athy*, by Openings made in the Mill Wiers for that Purpose; and though this Sort of Navigation is very imperfect, yet it may, with some Improvements, for a Time be sufficient for the Trade. Or, as the Mode of making a Navigation from *Portarlinton* to the Bridge of *Athy*, is no Ways difficult or expensive, the Company will have it in their Power, if they find it expedient, to perfect the Branch at once; and at the same Time proceed from the aforesaid Point of Junction with the *Figuile*, for the *Sbannon*.

As, according to the new proposed Plan, the Canal is to be carried no further in a direct
Line

Line into the *Bog of Allen*, than the Meeting of the *Blackwood* River, it seems that the Method of joining the *Boyne*, by Means of the *Blackwater* River, according to the Scheme of *Major Vallancey*, will best suit the Ground; by which a direct Passage from the *Barrow* to the *Boyne*, will be formed by Means of the *Blackwood* and *Blackwater* Rivers, united near the *Togher of Graig*, in the *Bog of Allen*.

Aulthorpe, 3d April,
1775.

J. SMEATON.